occluded, and the heat evolved represented the true heat of occlusion of this quantity of oxygen.

Indirectly, the same value was obtained by charging the platinum black up fully and alternately with hydrogen and oxygen, and finally with oxygen. The amount of oxygen really occluded in the last charge, and independent of that which had gone to form water, was then found by exhausting *in vacuo* at a red heat. The difference between this quantity and the total amount of oxygen used is a measure of the oxygen which formed water with twice as much hydrogen by volume. Knowing these quantities, the total heat evolved, the heat of formation of water, and the heat absorbed on the removal of hydrogen, we have all the data for calculating the heat of occlusion of oxygen.

In a similar way the amount of heat *absorbed* per gram of oxygen *removed* was calculated from the data obtained during the penultimate charge.

The mean value for the heat of occlusion of oxygen, from the direct and indirect measurements, which did not differ much from each other, is +11·0 K (1100 *g*-calories) per gram. This value referred to 16 grams of oxygen is +176 K, which is almost identical with Thomsen's measurement of the heat of formation of platinous hydrate $Pt(OH)_2$, viz., +179 K.

This agreement suggests the possibility that the two phenomena may in reality be identical, the necessary water being always present in platinum black dried *in vacuo*.

The paper concludes with some speculations on the nature of the occlusion of gases.

"On the Appearance of the Cleveite and other New Gas Lines in the Hottest Stars." By J. Norman Lockyer, C.B., F.R.S. Received June 15,—Read June 17, 1897.

Introductory.

In my recent paper on "The Chemistry of the Hottest Stars,"* I left for future discussion the spectra of those stars apparently at or near the apex of the temperature curve, for the reason that in them the lines of known gases do not show very great variations, while the enhanced lines cease to be of service as a criterion of temperature. I pointed out, however, that there were several lines, as yet of unknown origin, which are strong in some of these stars and weaker in others, and that the study of these might eventually help us in classifying such stars and arranging them in temperature

* 'Roy. Soc. Proc.,' vol. 61, p. 185.

order, but that before attempting to use the unknown lines in these inquiries it was important in the first instance to discriminate, if possible, between gaseous and metallic lines. Until this point was investigated the relative behaviour of the lines of hydrogen and cleveite gases near the upper temperature limit could not be satisfactorily discussed.

The work has now been carried on a stage further, and in the present paper I propose to give the results of the inquiry into (1) the appearances of the lines of gases, both old and new, in the spectra in question, and (2) the most probable sequence of temperature in the stars under discussion.

The Spectral Lines by which the Sequence of the Hottest Stars can be determined.

In the former paper I stated the sequence of certain stars, both of increasing and decreasing temperature, as determined chiefly by the enhanced lines of iron and the lines of the cleveite gases. At the junction of the two series I provisionally grouped together Bellatrix, ζ Orionis, η Ursæ Majoris, λ Tauri, and γ Pegasi, pointing out that their spectra were not quite identical and might afterwards be separated when the criteria had been further studied.*

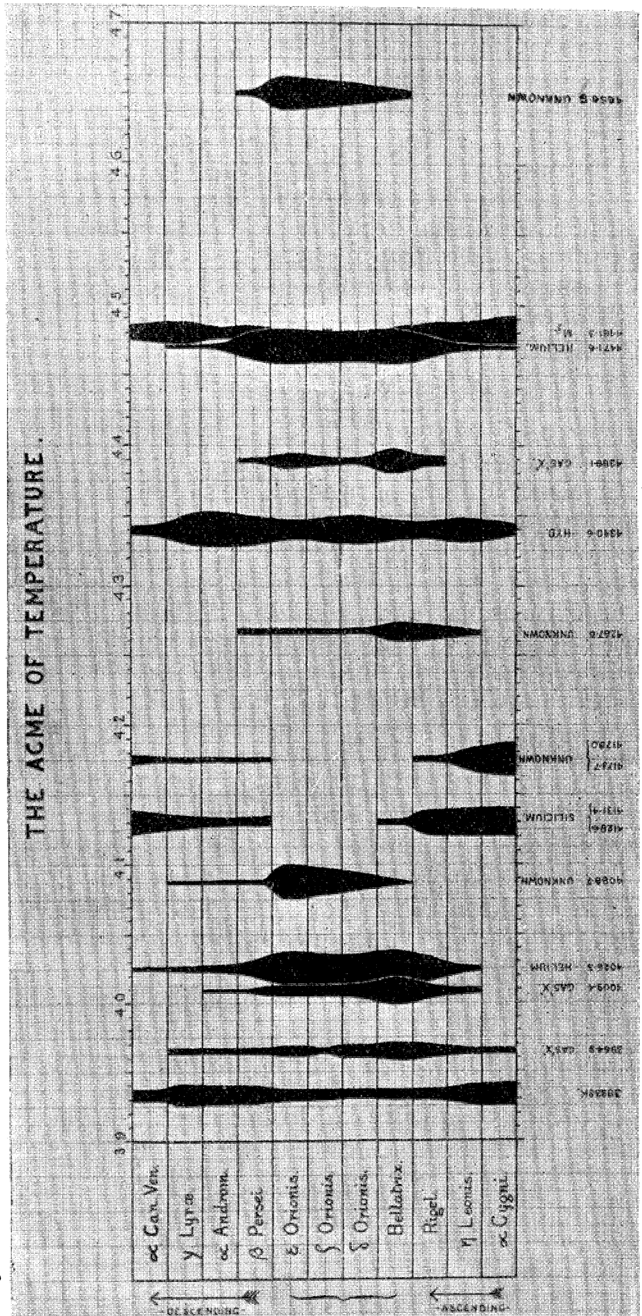
Further inquiry has shown that γ Pegasi may be regarded as practically identical with Bellatrix, while η Ursæ Majoris and λ Tauri differ from it chiefly in the general haziness of the lines; no attempt has been made, therefore, to separate these stars from Bellatrix. Other stars included in the present discussion were δ and ϵ Orionis. At the top of the ascending series of stars I placed Rigel and ζ Tauri,† and, among others, at the top of the descending series were β Persei and α Andromedæ.

The sequence of the still hotter stars can, therefore, be determined by an investigation of the varying intensities in their spectra of lines which appear; also in stars on one side or other of the temperature curve. The principal lines utilised in this inquiry are as follows:—

* 'Roy. Soc. Proc.,' vol. 61, p. 180.

† This is one of the most extraordinary spectra which has been met with in the Kensington series of photographs, as I have already pointed out ('Roy. Soc. Proc.,' vol. 61, p. 184). While the lines of hydrogen are fairly sharp and not very broad, many of the lines, especially those of the cleveite gases, are broadened almost into invisibility. On the meteoritic hypothesis this is explained by the great differences of velocity and direction of the meteoritic streams, the special broadening of the lines of the cleveite gases indicating that these gases are chiefly concerned in disturbances at high temperatures.

On account of the indistinctness of many of its lines, ζ Tauri is omitted from the present discussion.


THE ACME OF TEMPERATURE.
α Can. Ven.
γ Lyræ.
α Androm.
β Persei.
ε Orionis.
ζ Orionis.
δ Orionis.
Bellatrix.
Rigel.
η Leonis.
α Cygni.
DESCENDING
ASCENDING

3933·8 Ca(K)	4173·2 unknown.
3964·8 Gas X	4179·0 unknown.
4009·4 ,,	4340·6 Hg.
4026·3 He	4267·6 unknown.
4088·7 unknown	4388·1 Gas X.
4128·6 Si	
4131·4 Si	

The accompanying map shows the sequence of spectra in the hottest stars deduced from the behaviour of the above lines in passing from the stars of increasing temperature to stars of decreasing temperature, and includes also some of the typical stars on both sides of the curve, namely, α Cygni, η Leonis, and Rigel, and β Persei, α Andromedæ, γ Lyræ, and α Canum Venaticorum, in the order previously determined. In each case the intensities of the various lines are indicated by their thicknesses, so that the variations in passing from star to star are plainly shown. The wave-lengths of the lines and the origins of the known lines are shown at the bottom of the map.

The map enables us to discuss the relative behaviour of each of the lines, and to notice which thin out or become more intense as the temperature changes.

It will be seen that when one set of lines becomes very faint or disappears, another makes its appearance or becomes intensified.

The map thus shows the most probable sequence of spectra among the stars near the acme of temperature as deduced from the changes of intensity of the lines given above.

The Variations of the Cleveite Gas Lines.

Comparison of the Principal Lines of Helium and Gas X.—In discussing the appearance of gas X in relation to helium, it is necessary to deal with the subordinate series in each case, as the only line of the principal series of helium (λ 3888·785) which falls in the photographic region considered coincides with a hydrogen line, and cannot therefore be compared with the line of the principal series of gas X, which does come within range. Taking the lines 4471·6 and 4026·3 as representing helium, and 4388·1 and 4009·4 as representing gas X, the comparison shows that:—

1. Gas X does not vary absolutely with helium.
2. Gas X increases its intensity at a different rate from that of helium.
3. When helium is at about a maximum so is gas X. The maximum of gas X is, however, very short lived, while that of helium extends very considerably.

These differences are shown on the map, and they fully accord with the laboratory work, which indicates that helium and gas X are to be regarded as distinct substances.

Comparison of the Lines of the Subordinate Series.—In the above investigation it has been found that, in tracing the progress of gas X through the stars of increasing and decreasing temperature in the photographic region, the relative intensities of the lines of the different series are changed from those tabulated in the laboratory. The lines of the principal series, as indicated by the line at 3964·9, are no longer the strongest, but become of secondary importance as regards intensity, whilst the first subordinate series now takes the pre-eminent position, and the second subordinate series nearly disappears altogether, being only represented very feebly near the point of highest temperature.

In the following tables, drawn up by Mr. Shackleton, will be found a statement of the relative intensities of the principal, first subordinate, and second subordinate series of gas X and helium.

Relative Intensities in Stars of increasing Temperature of the Lines in the principal and subordinate Series of Gas X.

Star.	Principal series (λ 3964·9).	1st subordinate series (λ 4388·1).	2nd subordinate series (4437·7).
Bellatrix............	5	7	1
Rigel	4	3	—
η Leonis............	2	? trace	—
α Cygni	2	1	—
γ Cygni	—	—	—
α Orionis............	—	—	—

Relative Intensities in Stars of increasing Temperature of the Lines in the 1st and 2nd subordinate Series of Helium.

Star.	1st subordinate series (λ 4471·6).	2nd subordinate series (λ 4121·0).
Bellatrix............	10	4
Rigel	6	2—3
η Leonis............	2	1
α Cygni	1	1—2
γ Cygni	—	—
α Orionis............	—	—

Relative Intensities in Stars of decreasing Temperature of the Lines in the principal and subordinate Series of Gas X.

Star.	Principal series (λ 3964·9).	1st subordinate series (λ 4388·1).	2nd subordinate series (λ 4437·7).
Bellatrix	5	7	1
β Persei	2	3	—
γ Lyræ	2	1	—
Sirius	—	—	—
Castor	—	—	—
Procyon	—	—	—
Arcturus	—	—	—

Relative Intensities in Stars of decreasing Temperature of the Lines in the 1st and 2nd subordinate Series of Helium.

Star.	1st subordinate series (λ 4471·6).	2nd subordinate series (4121·0).
Bellatrix	10	4
β Persei	3	2—1
γ Lyræ	1	1
Sirius	—	—
Castor	—	—
Procyon	—	—
Arcturus	—	—

The above detailed investigations show that while helium and gas X behave differently as regards their appearance in stars, the constituent series of each, so far as we can at present study their behaviour, do not exhibit any remarkable differences. Thus in the stars of increasing temperature there is a steady increase of intensity of the three series of lines of gas X, and of the two series of helium lines, while in the case of cooling stars there is a decrease in the intensity of each series.

In the case of gas X it will be seen that the principal series is not intensified to the same extent as the first subordinate series in passing from Rigel to Bellatrix, and this seems to suggest that the molecules corresponding to the principal series do not survive so high a temperature as those which produce the lines of the first subordinate series.

There is, however, no sufficient reason for regarding the three series of gas X or of helium as representing separate constituents of

those gases, and for the present, at all events, each of the three series of helium or gas X may be taken to represent the vibrations of molecules of the same gas but of different complexities.

The differences in the stellar behaviour of helium and gas X have been confirmed by reference to the researches of Professor Vogel* and Professor Pickering.†

I suggest that the time has come to give gas X a definite name. It will be remembered that I pointed out in May, 1895,‡ that helium was only one constituent of the gas discovered by Professor Ramsay, which he imagined to consist of helium alone, and that there was spectroscopic evidence suggesting at least one other new element associated with helium.

Afterwards, in September, 1895, Professors Runge and Paschen came to the same conclusion,§ but their work still left indeterminate the number of elemental gases in the mixture.

In the many comparisons of the lines I had to make in my investigations I soon found the inconvenience of not having a name for the gas which gave 667, 501, and other lines, and I called it gas X for laboratory use. When, therefore, Professors Runge and Paschen, who had endorsed my results, and had extended them, called upon me, I thought it right to suggest to them that, sinking all questions of priority, we should all three combine in suggesting a name for this gas, the elemental character of which we had demonstrated.

This offer they declined,‖ and so far as I was concerned the matter dropped.

In the meantime Dr. Stoney has suggested the name "parhelium." But seeing that this word is already in use in another connection for a "mock-sun," its acceptance is, I think, impossible. I propose, therefore, the word "asterium," since it is in the stars that the behaviour of the new element has been best studied, and its appearance furnishes valuable evidence as to their chemistry.

The probable Existence of other New Gases in the Hottest Stars.

Discrimination between Gaseous and Metallic Lines.—The lines of helium, asterium, and hydrogen in the hottest stars are accompanied, as I have stated, by others which may either represent gases of a similar character, or metals at very high temperatures. It becomes important to consider the means at our command for distinguishing between gaseous and the metallic lines.

* 'Astrophysical Journal,' 1895, vol. 2, p. 333.

† 'Annals of the Harvard College Observatory,' vol. 28, Part I.

‡ 'Roy. Soc. Proc.,' vol. 58, p. 194.

§ 'Nature,' vol. 52, p. 321.

‖ 'Science Progress,' June, 1896, p. 278.

One possible method is this. In the nebulæ are found the lines of hydrogen, helium, and asterium associated with other bright lines of unknown origins; it is fair to assume that if other similar gases exist in the nebulæ, the other bright lines should belong to them. In the nebulæ all these probably exist at low temperatures, since no indication of the enhanced lines of Fe, Mg, Mn, Ti, &c., have been detected in the spectra of nebulæ, and on this ground we are driven to give up the old arguments in favour of the high temperature of the nebulæ, which depended for their validity upon the presence of "chomospheric" lines in the spectrum. The discovery of terrestrial helium has enabled its behaviour, when rendered luminous, to be studied, and we now know that its presence in a spectrum is no proof of a very high temperature.

Further, of all the lines other than hydrogen, helium, and asterium, so far discovered in the nebulæ, it would appear that only a few, if any, are certainly produced by metallic vapours.*

If, then, their origins be gaseous, as opposed to metallic, we should expect to find these lines in the spectrum of those stars in which the absorption of hydrogen and the cleveite gases which are associated with them in the nebulæ is strong. At present, this method of separating the gaseous from the metallic lines in the hotter stars cannot be finally applied, for the reason that the wave-lengths of many of the nebular lines are not sufficiently accurate for the object in view. But there is little doubt that it will furnish a valuable criterion when photographs with larger dispersion become available.

Another possible method, however, is open to us. In α Cygni, where the enhanced metallic lines are so strongly developed, the helium lines appear very feebly, and it is only in stars at still higher temperatures that helium is strongly represented. Hence, if there are other gases which behave like helium, in stars as well as nebulæ, they would be intensified in passing from α Cygni through successively hotter stars, while the enhanced metallic lines become feebler. Some of the principal lines which become thus intensified in passing to the hottest stars are indicated in the following table.

Five of the lines given in the table approximately coincide with enhanced lines, two with lines of cadmium and three with lines of sulphur, but since in the spectrum of the former substance there are fifteen enhanced lines in the same region, and in the latter twenty-nine, the coincidences may for the present be regarded as accidental.

It seems highly probable therefore that the lines recorded in the table represent gases which have yet to be discovered, and that the

* 'Phil. Trans.,' A, 1895, vol. 186, p. 76.

Lines other than Hydrogen and Cleveite Gases which make their appearance only at Temperatures higher than *a* Cygni, or become intensified at higher Temperatures.

Wave-length.	*α* Cygni.	Rigel.	Bellatrix.	ζ Orionis.
3919·2	—	—	3	—
3994·7	—	2	5	3
4040·6	—	—	3	—
4069·7	—	—	3	3
4071·7	—	—	3	—
4075·7	—	—	3	3
4088·7	—	—	—	8
4094·7	—	—	—	3
4104·8	—	—	3	—
4114·8	—	—	—	7
4172·6	—	—	2	—
4253·6	—	—	3	—
4267·6	—	3	7	2
4314·6	—	—	—	2
4345·6	—	—	3	—
4415·2	—	—	3	2
4541·8	—	—	—	2
4566·8	—	—	3	—
4574·8	—	—	3	—
4613·8	—	—	3	—
4643·8	—		3	—
4650·9	—	—	3	10

intensification of lines in the hottest stars in passing from *α* Cygni is a trustworthy criterion for gaseous lines.

If there are other gases which, like hydrogen, give indications of their presence at the temperature of *α* Cygni, or lower, the lines in the spectrum do not, like those of hydrogen, become more intense with increased stellar temperature. In such cases it does not seem likely that anything short of the actual discovery of terrestrial sources of the gases can help us to differentiate the lines belonging to them in stellar spectra from those due to metallic substances.

Attempts to trace Terrestrial Sources of the New Gases.—In a series of papers communicated to the Royal Society I have given an account of the attempts which I have made to find new gases by experiments upon minerals similar to those adopted for the extraction of helium and the associated gases from cleveite. In the last paper of that series I summarised the results which had been obtained, indicating that lines occurring in the spectra of gases from minerals for which no known origin could be assigned were represented in the spectra of some of the hotter stars.*

From this I extract the following list of the lines thus found to

* 'Roy. Soc. Proc.,' vol. 60, p. 133.

have probable counterparts in the hotter stars, and show the intensities in different stars. Lines which have since been found to correspond with enhanced lines in the spectra of any of the substances so far examined are omitted.

Stellar Lines probably coincident with Lines in the Spectra of Gases from various Minerals.

Wave-length.	α Cygni. Max. = 10.	Rigel. Max. = 10.	Bellatrix. Max. = 10.	δ Orionis. Max. = 10.
3929·4	—	—	—	1
3961 6	3	—	—	—
4002·9	5	—	—	—
4069·7	—	—	3	3
4072·2	1	—	3	—
4114·6	—	—	—	7
4309·4	1	—	—	—
4338·0	5	—	—	—

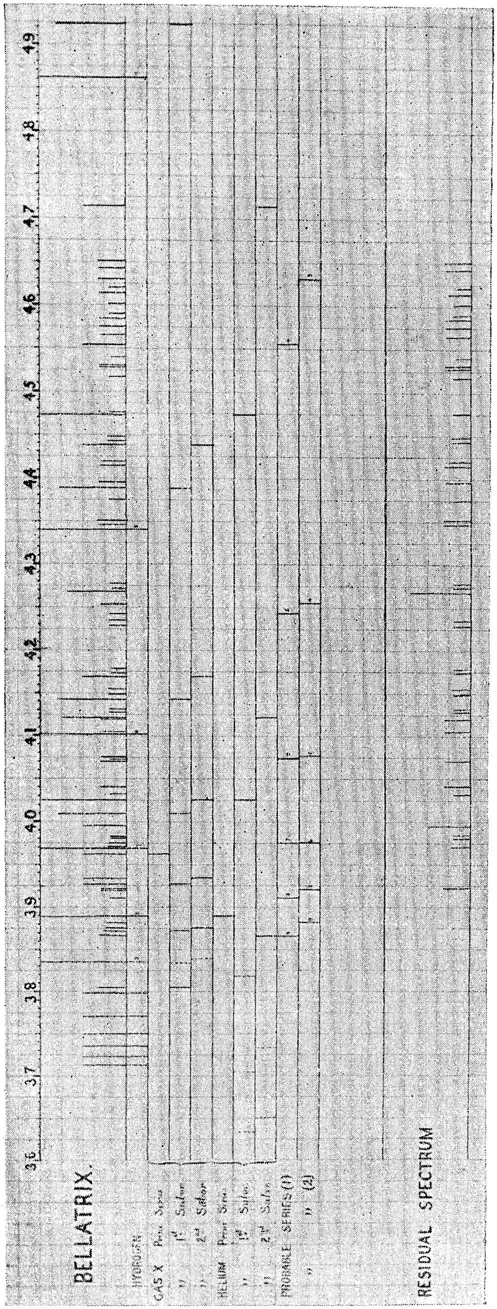
The lines thus observed in the spectra of mineral gases may be divided into two groups, the first comprising those which are strongest in α Cygni and thin out at higher temperatures, and the second those which are either absent from α Cygni or become stronger as the temperature of α Cygni is exceeded. The lines of the first group behave like the enhanced lines of the metals, and, unless the gases can be isolated, it is impossible to say whether the corresponding stellar lines are produced by gases or the coincidences are merely accidental.

In the case of the second group of lines, however, the probability that the mineral gases which give them really represent new lines is much greater, since, like the lines of helium, they are most intense in the stars which we have every reason to believe to be the hottest.

Attempts to Trace Series of Lines.—A minute examination of Bellatrix has been made by Dr. W. J. S. Lockyer with a view of inquiring whether some of the many still unknown lines might possibly form series like those of helium and asterium.

With this object the lines in the spectrum were carefully plotted, special attention being given to the intensities of the individual lines. An examination of the residual spectrum formed by omitting all those lines the origins of which were known, showed that possibly two further series were present, but a better photograph of the star spectrum is required to settle the matter definitely.

The residual lines in the spectrum of Bellatrix in the existing photographs after hydrogen, helium, and asterium have been with-


BELLATRIX.
3.6
3.7
3.8
3.9
4.0
4.1
4.2
4.3
4.4
4.5
4.6
4.7
4.8
4.9
HYDROGEN
GAS X
HELIUM
PROBABLE SERIES (1)
" (2)
RESIDUAL SPECTRUM

drawn, amount to upwards of fifty, and there can be no doubt that some of them represent gases not yet discovered on the earth. It may also be stated that these gases behave differently as regards their range of visibility through stars of varying temperatures.

The accompanying map shows the principal lines in the spectrum of Bellatrix, and indicates those which are due to hydrogen, helium, and asterium. The two probable new series which have been found by Dr. Lockyer are also shown.

The New Gas in ζ Puppis.

Professor E. C. Pickering has recently announced* that the spectrum of ζ Puppis contains a new series of lines, which he at first supposed to be due to some new element. In a second communication to the same journal,† he pointed out that he had reason to suppose that this new series was in some way connected with hydrogen, since he found that the observed lines occupied the same positions as those computed from the same formula and constants, from which the ordinary series of hydrogen was calculated, but using odd values of n instead of even values.

In the following table I have brought together all the lines published by Professor Pickering as belonging to the spectrum of this star, ranging them in different columns for greater clearness:—

Lines in the Spectrum of ζ Puppis.

Hydrogen.		Other lines with origins.	
Old Series (dark).	New Series (dark).	Dark.	Bright.
3798·1	3783·4	3933 Ca	4698 unknown
3835·5	3815·9	4472 He	5652 ,,
3889·1	3858·6	4505 unknown	
3970·2	3924·8	4620 ,,	
4101·8	4026·8	4633 ,,	
4340·7	4200·4	4688 ,,	
4861·5	4544·0		

In his first communication, Professor Pickering mentions lines at 4698, 4652, 4620, and 4505, but he does not refer to the first three in his second paper. The line 4505 was at first taken to be one of the components of the new series, but this seems to have been subse-

* 'Astrophysical Journal,' vol. 4, p. 369.
† 'Astrophysical Journal,' vol. 5, p. 95.

quently superseded by the employment of the line about 4544, which agrees better both as regards intensity and the calculated position 4543·6.

The question then arises, what relation does the spectrum of this star bear to those of other stars of high temperature?

A comparison of the lines recorded with those in the spectrum of Bellatrix shows that, with the exception of the new series and the lines at 4698, 4688, and 4505, many lines are common, as is indicated in the following table:—

Comparison of Spectrum of ζ Puppis with that of Bellatrix.

Lines in ζ Puppis (Pickering).	Probable coincident lines in Bellatrix.	Origins.
3783·4	—	H new series ($n = 21$).
3798·1	3798·1	$H\theta$.
3815·9	—	H new series ($n = 19$).
3835·5	3835·5	$H\eta$.
3858·6	—	H new series ($n = 17$).
3889·1	3889·1	$H\zeta$.
3924·8	—	H new series ($n = 15$).
3933·0	3933·0	K.
3970·2	3971·1	$H\epsilon$.
4026·8	—	H new series ($n = 13$).
4101·8	4101·0	$H\delta$.
4200·4	—	H new series ($n = 11$).
4340·7	4340·7	$H\gamma$.
4472·0	4471·0	Helium.
4505·0	—	Unknown.
4540·0	4541·0	Unknown.
4544·0	—	H new series ($n = 9$).
4620·0	4620·0	Unknown.
4633·0	4629·0	Unknown.
4652·0	4650·0	Unknown.
4688·0	—	Unknown.
4698·0	—	Unknown.
4861·5	4861·0	$H\beta$.

From the above it will be gathered that the only really marked difference between ζ Puppis and Bellatrix is the presence of this new series of lines in the spectrum of the former. As I have only at my command the published accounts of Professor Pickering and not an original photograph of this star, a more detailed comparison of the spectra cannot be made, but there seems to be evidence which points to a higher temperature for the star than that of Bellatrix.

Professors Pickering and Kayser both concede that this new form

of hydrogen is due most probably to a high temperature, and Professor Kayser expressly states that "this series has never been observed before, and can perhaps be explained by insufficient temperature in our Geissler tubes and most of the stars."* I pointed out in my former paper that this new series and the one previously known are probably of the subordinate type, and that the principal series is still unrecognised,† although some of the "unknown" lines in stars may possibly belong to it.

On the supposition that the new series of probable hydrogen lines in ζ Puppis represents the effect of a transcendental temperature, an attempt has been made to produce this spectrum in the laboratory. In the high-tension spark in hydrogen at atmospheric pressure the ordinary series of hydrogen lines is very broad, and none of the new series have so far been detected. The use of the spark with large jars in vacuum tubes results in the partial fusion of the glass and the appearance of lines which have been traced to silicium, while the new series has not yet been observed.

Final Result as to Temperature.

In the preliminary attempt to determine which are the hottest stars, the following facts and deductions have been considered:—

1. With increasing temperature hydrogen is first visible, then helium and asterium appear nearly together, and finally unknown lines at λλ 4088·7 and 4650·9 make their appearance.

2. The chief helium lines in the region covered by the photographs become much thicker after the α Cygni stage has been passed, and are practically of equal thicknesses in the stars Bellatrix, Spica, δ Orionis, ζ Orionis, ϵ Orionis, and β Persei, after which a sudden diminution in intensity takes place. These lines give us *no* criterion for the *hottest* star of the series.

3. With regard to the chief lines of asterium, namely, 4008·7 and 4388·1, in the region under investigation, these both rise to a very decided maximum in Bellatrix, diminishing afterwards in intensity less rapidly than they increased. The great development of asterium after the lines of helium have reached a considerable thickness suggests a higher temperature for Bellatrix than the neighbouring stars in the series.

4. As asterium begins to decrease in intensity, the two unknown lines before referred to at λλ 4088·7 and 4650·9 commence to brighten, reaching a maximum at ϵ Orionis, in which the hydrogen lines are still at a maximum, but asterium has considerably decreased. Only a trace, if any, of these lines can be found in Bellatrix. If

* 'Astrophysical Journal,' vol. 5, p. 96.

† 'Roy. Soc. Proc.,' vol. 61, p. 195.

these lines when at maximum are indications of a higher temperature than those of asterium, then, since the hydrogen and helium lines are also at a maximum, ε Orionis on this assumption would be the hottest star of the series.

With our present data it is, however, difficult to state with certainty whether the principal series of helium or of asterium makes its appearance first. There seem, however, to be indications which suggest that asterium is a somewhat later development.

In summing up I may say that ε Orionis may be considered the hottest star from the behaviour of the lines at 4481·3, 4088·7, 4650·9, while 4008·7, 4267·6, and 4388·1 favour the star Bellatrix in this respect.

The helium lines (4026·3 and 4471·6) have practically the same intensity in both stars, or at any rate there is not sufficient difference to serve as a criterion.

General Conclusions.

1. The order of temperature of stars at and near the apex of the temperature curve can only be determined by reference to unknown lines, since the enhanced lines of iron are absent, and those of magnesium and calcium are exceedingly feeble, while the lines of the known gases show no very marked variations.

2. The varying appearances of the lines of the cleveite gases indicate, as laboratory work has done, that helium and gas X are distinct substances, but there is not yet sufficient evidence for regarding the constituent series as belonging to separate substances. It is therefore considered that gas X should be definitely named, and the name "asterium" is suggested.

3. There are two methods open to us for discriminating between gaseous and metallic lines of still unknown origin in the spectra of the hottest stars. (*a*) Gaseous lines like those of helium and hydrogen will be common to nebulæ and the hottest stars. (*b*) Metallic lines like those of iron, magnesium, and calcium will thin out at increased stellar temperature, while gaseous lines will become intensified.

4. Several unknown lines in the spectra of the hottest stars are thus shown to be most probably of gaseous origin.

5. Attempts to trace terrestrial sources of these stellar gases have resulted in the detection of lines which probably coincide with lines in the spectra of the hottest stars.

6. On the supposition that these stellar gases are more or less allied to helium and asterium, since they have their maximum intensity in the same stars, attempts have been made to trace "series" of lines in the spectra. In the case of Bellatrix two probable series have already been recognised.

7. The new series of probable hydrogen lines in ζ Puppis most likely represents the effect of a transcendental temperature. This and the well-known series are in all probability of the subordinate type, the lines of the principal series not yet having been identified in stars.

8. There is evidence which points to a higher temperature for ζ Puppis than for Bellatrix.

9. The behaviour of certain lines suggests that Bellatrix may be taken as a type of the hottest stars, while the behaviour of others seems to indicate that ϵ Orionis should be regarded as a star of the very highest temperature, exception being made of ζ Puppis. There are not yet sufficient data to enable a final statement to be made.

"A Maya Calendar Inscription, interpreted by Goodman's Tables." By ALFRED P. MAUDSLAY. Communicated by F. DUCANE GODMAN, F.R.S. Received April 2,—Read June 17, 1897.

[*Introductory Note.*

Our knowledge of the Maya Calendar is chiefly derived from the writings (A.D. 1566) of Diego de Landa, Bishop of Yucatan, who not only gave some account of the divisions of time in use among the Mayas, but also copied, somewhat roughly, in his manuscript the signs employed to represent the eighteen named months, and the twenty named days into which each month was divided.

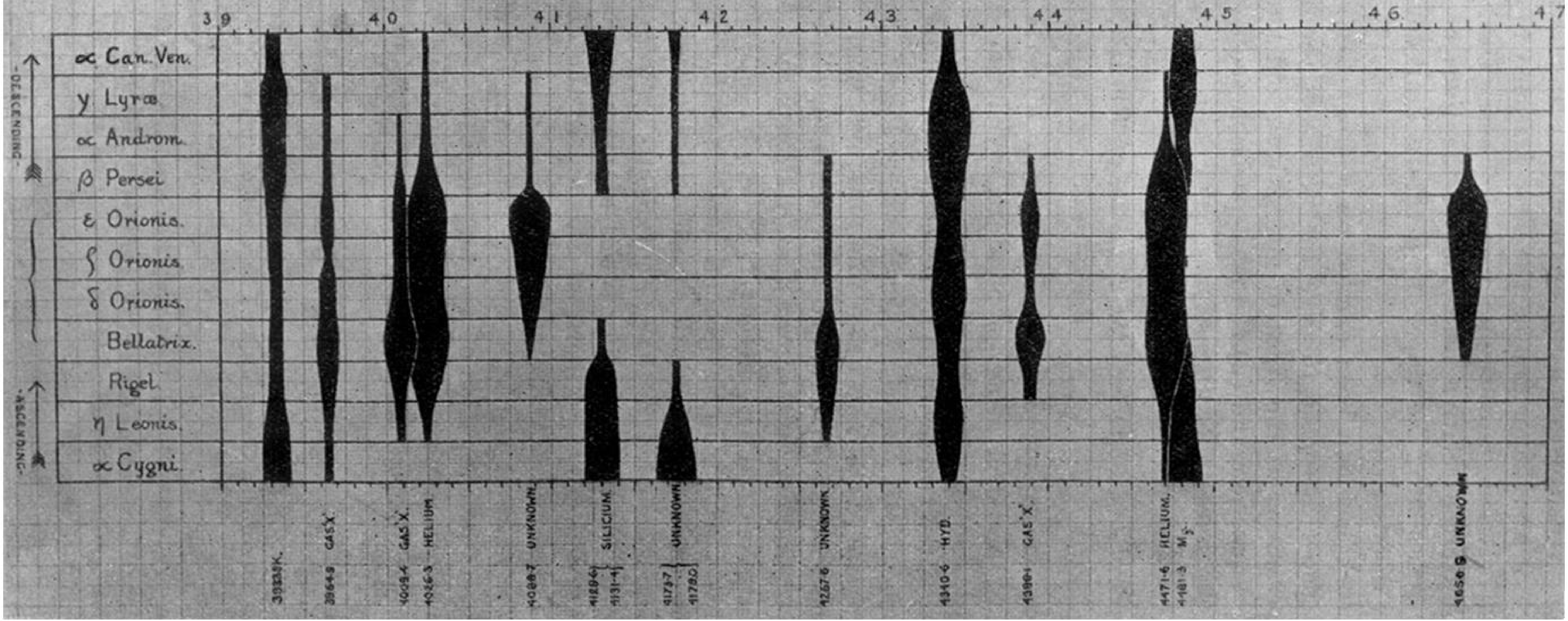
Landa's statements are, however, by no means clear, and there has been much discussion both as to their correctness in themselves and as to the interpretation which has been given to them; moreover, it has been found difficult in some instances to identify the day and month signs given by him with those used in the Dresden Codex and the few Maya manuscripts which have been preserved, and still more difficult to identify them with the signs used in the carved inscriptions.

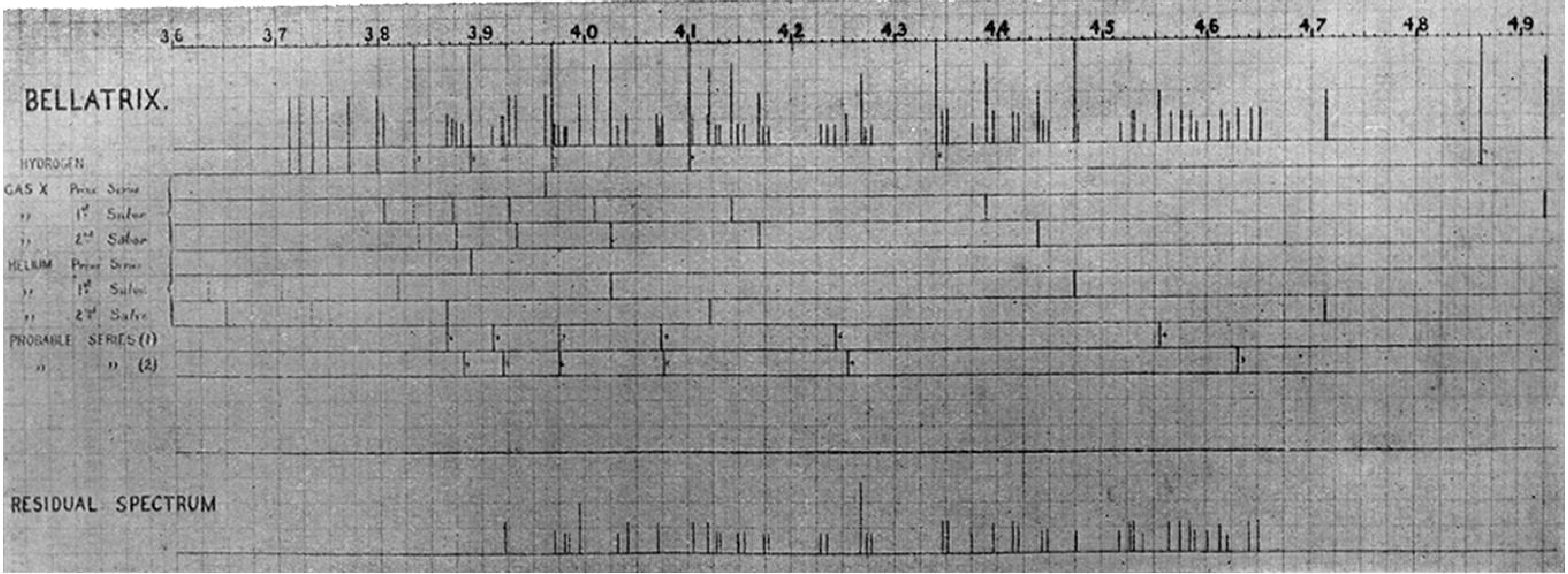
In the accompanying paper an examination is made of a recently discovered inscription, by the aid of calendar tables prepared by Mr. J. T. Goodman, and published with an explanatory essay in the 'Biologia Centrali-Americana.' These tables consist of a chronological and an annual calendar. The chronological calendar is based on the Ahau, a period of 360 days, and is divided thus:—

20 days	1 chuen
18 chuens	1 ahau* (360 days)

* It is unfortunate that the *ahau*, or period of 360 days, bears the same name as one of the twenty days of the Maya month, and that the *chuen*, or twenty-day period, bears the name of another day of the month.

THE ACME OF TEMPERATURE.




3.6
3.7
3.8
3.9
4.0
4.1
4.2
4.3
4.4
4.5
4.6
4.7
4.8
4.9
BELLATRIX.
HYDROGEN
GAS X
HELIUM
PROBABLE SERIES (1)
(2)
RESIDUAL SPECTRUM